IS 10014-2 (1981): Methods of Tests for Man - Made Staple Fibres, Part 2: Determination of Linear Density [TXD 1: Physical Methods of Tests]

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IS : 10014 ( Part II ) - 1981

# *Indian Standard*

# METHODS OF TESTS FOR MAN-MADE STAPLE FIBRES

## PART II DETERMINATION OF LINEAR DENSITY

UDC 677·4-486·1 : 677·017·272



**INDIAN STANDARDS INSTITUTION**
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# IS 10014 ( PART 2 ) : 1981 METHODS OF TEST FOR MAN-MADE STAPLE FIBRES

## PART 2 DETERMINATION OF LINEAR DENSITY

( *Page* 5, *clause* **6.3.1**, *line* 8 )

( *Page* 6, *clause* **7.2.2**, *line* 1 )

( *Page* 7, *clause* **7.3.1**, *line* 2 ) — Substitute '100' *for* '50'.

( *Page* 7, *clause* **7.3.1**, *line* 4 )

( *Page* 7, *clause* **7.3.1**, *line* 5 )

( *Page* 6, *clause* **7.2.2**, *line* 7 ) — Substitute '99' *for* '49'.

(TX 01)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 NOVEMBER 1985

TO

# IS:10014 (Part II)-1981 METHODS OF TESTS FOR MAN-MADE STAPLE FIBRES

## PART II DETERMINATION OF LINEAR DENSITY

(*Page 5, clause 6.2.1, line 7*) - Substitute '100 fibres' *for* '50 fibres'.

(TDC 1)

Reprography Unit, ISI, New Delhi, India

# AMENDMENT NO. 1 JULY 1983

TO

# IS : 10014 ( Part II ) - 1981 METHODS OF TESTS FOR MAN-MADE STAPLE FIBRES

## PART II DETERMINATION OF LINEAR DENSITY

### Corrigenda

( *Page* 4, *clause* **5.1**, *line* 3 ) — Substitute ' 16 hours ' *for* ' ±6 hours '.

( *Page* 6, *clause* **6.3.3** *and Note thereunder* ) — Substitute the following for the existing clause:

'**6.3.3** Calculate the average of the five readings and report the average value and the coefficient of variation.

NOTE — The coefficient of variation value shall be calculated as follows:

$$\text{Coefficient of variation, CV, percent} = \frac{\sigma d}{\bar{d}} \times 100$$

where

$$\sigma d = \sqrt{\frac{d_1^2 + d_2^2 + \ldots\ldots d_5^2 - \frac{(\Sigma d_1)^2}{5}}{4}}$$

(Tbc 1)

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# *Indian Standard*

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( *Continued on page* 10 )

# *Indian Standard*

# METHODS OF TESTS FOR MAN-MADE STAPLE FIBRES

## PART II DETERMINATION OF LINEAR DENSITY

## 0. FOREWORD

**0.1** This Indian Standard ( Part II ) was adopted by the Indian Standards Institution on 11 December 1981, after the draft finalized by the Physical Methods of Test Sectional Committee had been approved by the Textile Division Council.

**0.2** In the preparation of this standard due weightage has been given to the testing practices followed in the country in this field

**0.3** This standard forms a part of the series of standard under the title 'Methods of test for man-made staple fibres'.

**0.4** Standards of Weights and Measures Act, 1976 stipulates the use of International System of Units in the country, in order to familiarise the industry with this system, the recommended SI units for use in the textile industry are given in Appendix A.

**0.5** In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

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## 1. SCOPE

**1.1** This standard ( Part II ) prescribes two methods for the determination of average linear density of staple fibres One method applies to fibres cut to a definite length and the other to whole fibres. This standard is not suitable for blends having different, nominal linear densities.

**1.2** The methods may not give sufficiently accurate estimation of the linear density if the fibres are highly crimped.

*Rules for rounding off numerical values ( *revised* )

## 2. PRINCIPLE

**2.1** In both the methods, the length and mass of conditioned fibres are determined and the linear density is calculated from these values.

## 3. TERMINOLOGY

**3.1 Linear Density** — The mass per unit length of fibre. It is usually expressed in millitex or denier.

**3.1.1** *Millitex* — The mass in milligrams per kilometre length of the fibre. 1 mtex ( millitex ) = 0·001 tex.

**3.1.2** *Denier* — The mass in grams of 9 km length of the fibre

## 4. SAMPLING

**4.1** The sampling shall be done according to sampling procedure given in IS : 4807-1968*.

## 5. ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

**5.1** Prior to test, the test sample shall be preconditioned and then conditioned to moisture equilibrium in standard atmosphere at 65±2 percent relative humidity and 27°±2°C temperature for at least ± 6 hours ( *see* also IS : 6359-1971† ).

## 6. METHOD A ( APPLICABLE TO CUT FIBRE BUNDLES )

### 6.1 Apparatus

**6.1.1** Means for cutting a fibre bundle to an accurately known length.

NOTE — A convenient cutter consists of two sharp razor blades set parallel 20 mm apart in a holder.

**6.1.2** *Forceps* — for collecting the fibres.

**6.1.3** *Black Velvet Pad*

**6.1.4** *Microbalance* — suitable for weighing to an accuracy of 0·005 mg.

**6.1.5** *A steel comb* — having about 12 needles per centimetre.

*Methods of testing viscose rayon staple fibres
†Methods for conditioning of textiles.

**6.1.6** *Magnifying Glass*

**6.1.7** *Glass Slide*

## 6.2 Procedure

**6.2.1** Select five tufts from a well spread out sample. Parallelize them thoroughly by gently combing both sides alternately. Clamp one end of a tuft and again parallelize them. Apply a suitable tension sufficient to remove the crimp in the fibres and grip the free end of the tuft. Ensure that all the fibres are caught at both the grips. Using the cutter cut the middle portion. Collect the fibres and place on the velvet pad. ( *see* Note 1 ). Cover it with a glass slide. Collect 50 fibres and weigh in the microbalance to an accurately of 0·005 mg. Repeat the procedure with the remaining four tufts.

NOTE 1 — The operation of combing of tufts, parallelization, cutting, etc, are done prior to preconditioning and conditioning of the test specimens; this will ensure that the fibres are not handed by hand after conditioning.

NOTE 2 — A magnifying glass will help to avoid miscounting the fibres while collecting

NOTE 3 — Cutting should be carried out in such a way that there is no lateral movement of the fibres while cutting This can be ensured by placing the fibre bundle under tension over a rigid base with the fibres lying straight on the base

NOTE 4 — Tension to be applied is tex/2 or denier/18 which may be obtained by preliminary test.

## 6.3 Calculation

**6.3.1** Calculate the linear density millitex or denier using the following equation:

$$\text{mtex ( millitex )} = \frac{m}{n \times l} \times 10^6$$

OR

$$\text{d ( denier )} = \frac{m}{n \times l} \times 9000$$

where

$m$ = mass, in mg, of the bundle of fibres,

$n$ = number of fibres ( 50 in this case ), and

$l$ = cut length, in mm

**6.3.2** Calculate the linear density of the remaining four tufts.

**6.3.3** Calculate the average of the five readings and report the average value and the coefficient of variation.

NOTE — The coefficient of variation value shall be calculated as follows

$$\sigma d = \sqrt{\frac{d_1^2+d_2^2 \ldots +d_5^2 - \frac{(\Sigma di)^2}{5}}{4}}$$

## 7. METHOD B ( APPLICABLE TO WHOLE FIBRES )

### 7.1 Apparatus

**7.1.1** *Velvet Pad*

**7.1.2** *Forceps*

**7.1.3** *A Fine Steel Comb*

**7.1.4** *A Scale* — graduated to 0.5 mm;

**7.1.5** *Microbalance* — suitable for weighing to an accuracy of 0·005 mg.

**7.1.6** *Glass Plate*

**7.1.7** *Liquid Paraffin or Petroleum Jelly*

**7.1.8** *Magnifying Glass,*

**7.1.9** *Glass Slide*

### 7.2 Procedure

**7.2.1** Select five tufts at random, from a well spread out sample. Parallelize them well by gently combing both sides. Place them on the velvet pad ( *see* Note 1 under **6.2.1** ). Cover the tuft with a glass slide.

**7.2.2** Pick out one fibre after another and thus collect 50 fibres from parallelized tuft. Weigh in the microbalance to an accuracy of 0·005 mg. Record the weight. Place them on the clean portion of the velvet pad. Pick out one fibre and place it on the glass plate smeared with paraffin or petroleum jelly. Gently straighten the fibre using the forefingers to remove all the crimp. Measure the length of the straightened fibre to an accuracy of 0·5 mm. Measure all the remaining 49 fibres and record the length. Repeat the above procedure of weighing and measuring length for all the remaining 4 tufts.

### 7.3 Calculation

**7.3.1** Calculate the linear density millitex or denier as follows:

$$\text{mtex ( millitex )} = \frac{m}{50 \times l} \times 10^6$$

OR

$$\text{d ( denier )} = \frac{m}{50 \times l} \times 9000$$

$m$ = mass, in mg, of 50 fibres, and
$l$ = is the length, in mm, of a fibre.

**7.3.2** Calculate the linear density of the remaining 4 tufts.

**7.3.3** Calculate the average of the 5 values and report the average value and coefficient of variation value.

NOTE — The coefficient of variation shall be calculated by using formula given in Note under 6.3.3.

## 8. REPORT

**8.1** The test report shall include the following:

a) the method used;
b) the cut length ( in the case of method A );
c) the average linear density in millitex or denier; and
d) the coefficient of variation value.

# APPENDIX A

( *Clause* 0.4 )

**RECOMMENDED SI UNITS FOR TEXTILES**

| Sl No. | Characteristic | SI Unit | | Application |
|---|---|---|---|---|
| | | Unit | Abbreviation | |
| (1) | (2) | (3) | (4) | (5) |
| 1. | Length | Millimetre | mm | Fibres |
| | | Millimetre, centimetre | mm, cm | Samples, test specimens ( as appropriate ) |
| | | Metre | m | Yarns, ropes, cordage, fabrics |
| 2. | Width | Millimetre | mm | Narrow fabrics |
| | | Centimetre | cm | Other fabrics |
| | | Millimetre, centimetre | mm, cm | Samples, test specimens ( as appropriate ) |
| | | | | Carpets, druggets, *DURRIES* ( as appropriate ) |
| 3. | Thickness | Micrometre ( micron ) | $\mu$m | Delicate fabrics |
| | | Millimetre | mm | Other fabrics, carpets, felts |
| 4. | Linear density | Tex | tex | Yarns |
| | | Millitex | mtex | Fibres |
| | | Decitex | dtex | Filaments, filament yarns |
| | | Kilotex | ktex | Slivers, ropes, cordage |
| 5. | Diameter | Micrometre ( micron ) | $\mu$m | Fibres |
| | | Millimetre | mm | Yarns, ropes, cordage |
| 6. | Circumference | Millimetre | mm | Ropes, cordage |
| 7. | Threads in fabric | | | Woven fabrics ( as appropriate ) |
| | a) Lengthwise | Number per centimetre | ends/cm | |
| | | Number per decimetre | ends/dm | |
| | b) Widthwise | Number per centimetre | picks/cm | |
| | | Number per decimetre | picks/dm | |
| 8. | Warp threads in loom | Number per centimetre | ends/cm | Reeds |
| 9. | Stitches in knitted fabric | | | Knitted fabrics ( as appropriate ) |
| | a) Lengthwise | Courses per centimetre | courses/cm | |
| | | Courses per decimetre | courses/dm | |
| | b) Widthwise | Wales per centimetre | wales/cm | |
| | | Wales per decimetre | wales/dm | |

( *Continued* )

**RECOMMENDED SI UNITS FOR TEXTILES** – *Contd.*

| Sl No. | Characteristic | SI Unit | | Application |
|---|---|---|---|---|
| | | Unit | Abbreviation | |
| (1) | (2) | (3) | (4) | (5) |
| 10 | Stitch length | Millimetre | mm | Knitted fabrics, made-up items |
| 11 | Mass per unit area | Grams per square metre | $g/m^2$ | Fabrics |
| 12. | Mass per unit length | Grams per metre | g/m | Fabrics |
| 13 | Twist | Turns per centimetre<br>Turns per metre | turns/cm<br>turns/m | Yarns, ropes, cordage ( as appropriate ) |
| 14 | Test or gauge length | Millimetre, centimetre | mm, cm | Fibre, yarn and fabric specimens ( as appropriate ) |
| 15 | Breaking load | Millinewton | mN | Fibres, delicate yarns (individual or skeins ) |
| | | Newton | N | Strong yarns (individual or skeins), ropes, cordage, fabrics |
| 16. | Breaking length | Kilometre | km | Yarns |
| 17 | Tenacity | Millinewton per tex | mN/tex | Fibres, yarns (individual or skeins ) |
| 18 | Twist factor or twist multiplier | Turns per centimetre × square root of tex | turns/cm × $\sqrt{\text{tex}}$ | Yarns ( as appropriate ) |
| | | Turns per metre × *square root of tex* | turns/m × $\sqrt{\text{tex}}$ | |
| 19 | Bursting strength | Newton per square centimetre | $N/cm^2$ | Fabrics |
| 20 | Tear strength | Millinewton, newton | mN, N | Fabrics ( as appropriate ) |
| 21. | Pile height | Millimetre | mm | Carpets |
| 22 | Pile density | Mass of pile yarn in grams per square metre per millimetre pile height | $g/m^2$/mm pile height | Pile carpets |
| 23. | Elastic modulus | Millinewton per tex per unit deformation | mN/tex/unit deformation | Fibres, yarns, strands |

( *Continued from page* 2 )

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# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

## Base Units

| *Quantity* | *Unit* | *Symbol* |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Electric current | ampere | A |
| Thermodynamic temperature | kelvin | K |
| Luminous intensity | candela | cd |
| Amount of substance | mole | mol |

## Supplementary Units

| *Quantity* | *Unit* | *Symbol* |
|---|---|---|
| Plane angle | radian | rad |
| Solid angle | steradian | sr |

## Derived Units

| *Quantity* | *Unit* | *Symbol* | *Definition* |
|---|---|---|---|
| Force | newton | N | 1 N = 1 kg.m/s$^2$ |
| Energy | joule | J | 1 J = 1 N.m |
| Power | watt | W | 1 W = 1 J/s |
| Flux | weber | Wb | 1 Wb = 1 V.s |
| Flux density | tesla | T | 1 T = 1 Wb/m$^2$ |
| Frequency | hertz | Hz | 1 Hz = 1 c/s ($s^{-1}$) |
| Electric conductance | siemens | S | 1 S = 1 A/V |
| Electromotive force | volt | V | 1 V = 1 W/A |
| Pressure, stress | pascal | Pa | 1 Pa = 1 N/m$^2$ |

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